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54 Title: Grinding Cylinders

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"Abrasive Cylinder"

When grinding plate-shaped parts of wood or other parts, then cylinder grinding machines have over the wide-belt sanders the advantage of the longer tool life as well as of the lower costs of production and abrasive material. They do, however have in comparison to the wide-belt sanders the disadvantage that they require relatively long set-up times and are less capable of being stress-loaded, as well as lead to machined surfaces that have undesired chatter marks. The construction of the grinding cylinders and the method of fastening for the abrasives to them are responsible for the shown faults of the cylinder grinding machines.

Known are basically two types of the mounting for the abrasive paper or of the abrasive web[3], in particular the straight covering[4] on one hand and the spiral covering on the other hand.

In the case of a straight covering, an abrasive belt with a width which is somewhat larger than the circumference of the grinding cylinder is wound around the cylinder body, thus the cylindrical roll, and fastened and tensioned by means of clamping bars which extend over the entire length of the grinding cylinder. The fastening and clamping bars must be located under the surface of the cylinder, which has as consequence that the outer abrasive jacket is interrupted along a s strip. This strip may indeed be kept relatively

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[1] illegible
[2] *ltd.*
[3] or *belt*

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small, but the interruption nevertheless remains present. As a consequence of that, the grinding process is also interrupted for a short time during every revolution of the grinding cylinder. These interruptions result in chatter marks in the grinding pattern.

The spiral covering was developed in order to avoid these abrupt interruptions which have an unfavorable effect on the smoothness of running and the vibration behavior of the grinding cylinder. A web of sanding paper, the width of which corresponds approximately to twice the diameter of the cylinder, is hereby wound in a steep spiral around the cylindrical roll, whereby the edges of the web of sanding paper overlap by about 20 mm. In order for the abrasive paper to not extend in this location past the surface of the grinding cylinder, the felt lining present underneath the abrasive paper is omitted or interrupted along a spirally shaped strip such that the overlapping of the abrasive paper can lay into the groove[5] formed in this way. The abrasive paper is fastened to the roll in that at one end of the roll it is held through a suitable [means of] fastening and at the other end pulled in a spiral direction by a [bottom] clamping plate arranged to be axially shiftable in a spiral direction and is tensioned through this. The tensioning may take place by way of spring power or through a suitably placed pneumatic cylinder, for instance according to the German patent document 1 151 750. Such tensioning devices are complicated and expensive in their manufacture. They have moreover the disadvantage that with grinding cylinders larger than a certain width, larger than about 2.3 m, the abrasive layer can no longer be tensioned perfectly because the force necessary for that which must be exerted by the tensioning device on the abrasive layer by way of the [bottom] clamping plate would surpass in the place of introduction of the force the tensile strength of the layers. But in the case of [a] low force of tensioning, starting from a certain distance from the tensioning device the spirally applied abrasive layer is no longer sufficiently tensioned such that abrasive dust may penetrate in the locations of overlap and sets between [the] abrasive layer and felt. With that, the diameter of the fly circle of the abrasive increases in places, through which chatter marks are created. In addition, with spiral covering no grinding pressure may be applied where the sanding paper overlap is present, such that during each revolution the grinding process is interrupted for a short time and chatter marks are also generated in the grinding pattern. With little

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[4] or *mounting*
[5] or *gap*

flexible abrasive paper layers with a coarse grit, the overlap may not be accommodated entirely in the groove. This has an effect in that in particular with low chip removal the spirally shaped overlap strip removes more material from the surface to be abraded than the remaining part of the surface of the grinding cylinder. Chatter marks may be formed through this, too.

The felt layer present underneath the abrasive layer in the case of the straight as well as the spiral covering must be replaced from time to time due to the compaction[6] caused by the abrasion process, which takes up several hours because of the necessary curing time for the adhesive. If the abrasive layer tears in a location, for example, due to local overloading, then the entire layer is pulled off the cylinder, and in most cases the felt layer is also destroyed such that a new felt layer must be glued on.

A further disadvantage of the customary grinding cylinder is that it is not well suitable for grinding jobs in which a higher quality of the abraded surface matters: The relatively rigid grinding cylinder surface barely levels off through the grinding pressure, in contrast to a contact roll surface which as a rule is provided with a rubber layer 20-25 mm in thickness. For this reason, the individual abrasive grains in the customary grinding cylinder is in use over only very short distances, which has a negative effect on the grinding quality.

Due to the relatively low coefficient of friction between the felt layer and the abrasive layer, as well as the parallel paper covering present only on one side of the cylinder it is impossible to transmit from the roll to the abrasive belt the same power as is transmittable with the present-day wide belt contact grinding machines.

It is the object of the invention to create a grinding cylinder for the abrasion of plate-shaped parts of wood or other materials, which is built and provided with abrasive such that the disadvantages shown are in part removed entirely, in part reduced considerably.

With a grinding cylinder of the indicated kind, the intended goal is achieved according to the invention in that the abrasive belt is dimensioned relatively narrow, for example, with a width of 100 to 150 mm and wound spirally onto the grinding cylinder body, with the

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[6] or *packing*

edges joining against one another largely jointlessly and is bonded to it through an adhesive bond, whereby the grinding cylinder body may, as a function of the type of the grinding task, be provided with a rubber coating.

When designing the grinding cylinder in the manner according to the invention, a considerable simplification of the grinding cylinder construction can be achieved through the omission of the tensioning device in spiral direction for the grinding layer necessary until now and with that a lowering [is achieved] of the costs of manufacture. The basic construction of the glued belt can be simpler and with that more cost-effective than with the tensioned belt. Besides, the tool life of the grinding belt is increased, through which the costs for the abrasive are strongly reduced. Added to this is that the chatter marks are significantly reduced on the sanded surface, the grinding quality is thus improved considerably. The grinding capacity, too, can be heightened considerably as a consequence of the intimate two-dimensional adhesive bond between the roll and the abrasive layer and the better transfer of force connected with this. Also the time needed until now for applying the grinding belt decreases considerably. The felt layer is furthermore omitted, for the gluing of which several hours had to be used until now. Added to this is that as a consequence of the gluing of the abrasive layer to the roll, it is no longer [the case that] the entire abrasive layer come loose under local overloading or local damaging of the layer and is thus [no longer] destroyed. The down times of the cylinder grinding machines are consequently decreased.

It can further be of particular advantage if a sleeve of rubber or [a] similar material is vulcanized onto the roll and if the abrasive belt is fastened onto this sleeve by means of the adhesive bond.

By applying the rubber layer between [the] abrasive belt and roll, a grinding is achieved on cylinder grinding machines which is very similar to the grinding with contact rolls.

The adhesive bond can be achieved by means of an adhesive directly between the roll and the abrasive belt. In many cases, however, it may be of advantage if the adhesive bond is formed by means of a double-sided adhesive synthetic material web, whereby this is dimensioned relatively narrowly, for example, has a width of 100 to 150 mm and is spirally wound onto the grinding cylinder body, with the edges joining against one

another largely jointlessly. In the case of the same width for the synthetic material foil web and abrasive web it is recommendable to arrange the joints of the webs to be offset [from one another].

The adhesive bond can be achieved with advantage also in that the abrasive web is laminated on the back side with a self-adhesive foil and is bonded by means of that to the roll. The embodiment may also be designed if needed so that on the back side the abrasive belt is directly coated with a self-adhesive adhesive.

The invention is explained in the following by means of the drawing which visualizes an example of embodiment. [The figures] show:

Fig. 1 a representation explaining the formation of a grinding cylinder,

Fig. 2 the section circled in Fig. 1 with a dash-and-dotted [line], magnified,

Fig. 3 a representation in agreement with Fig. 2 of a grinding cylinder with [a] modified structure.

In the embodiment according to Fig. 1, at first the double-sided adhesive web[7] of synthetic material web 2 which has a width, for example, of 100 to 150 mm is wound spirally in the direction of the arrow A in one single layer onto a cylindrical roll 1 which may have, for example, a length of up to 4 m and more. It is thereby ensured that the edges 3, 4 abut directly against one another and border against one another practically without the groove 5 shown in the drawing. The grooves 5 are represented in the drawing merely for clarity reasons.

The abrasive web 6, which is also kept relatively narrow and has a width of about 100 to 150 mm, is then also wound spirally in the direction of the arrow A onto the adhesive web 2. In the illustrated construction, the webs 2 and 6 are kept equally wide. This is not necessary. At the starting end of the web, the webs 2 and 6 are certainly cut to size in agreement with the selected [axial] pitch so that they taper off into a tip 7. The webs 2 and 6 are cut also at the end of the roll 1 such that their free edges run parallel to the front end 8 of the roll 1.

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[7] or *tape*

Neither the synthetic material web nor the abrasive web are overlapping in any place, as is recognizable from Fig. 1 and 2.

Instead of a double-sided adhesive synthetic material web 2, the roll 1 may also be coated directly with a suitable adhesive. The abrasive web 6 is then applied, again in a spiral form and as gap-free as possible, and pressed against the roll 1 prepared in this way. The pressing may be done by hand or by means of a manually-guided pressure roll. An excellent surface contact between the roll 1 and the abrasive web 6 is created after a very short grinding period such that forces considerably larger than until now can be transferred from the roll 1 to the abrasive web 6. The grinding capacity can be increased considerably through that.

According to Fig. 2, the joint locations 9 of the edges of the individual turns of the abrasive web 6 coincide with the grooves 5 of the synthetic material web 2. But this need not be [the case], not even with the width of the two webs 2 and 6 coinciding as provided in Fig. 2. It is rather possible shift without difficulty the grooves of the webs 6 and 2 with respect to one another by starting the winding of the webs 2 and 6 in different locations of the circumference of the roll 1.

Due to the width of the abrasive web 6 [being] small in comparison to the diameter of the grinding roll 1, the pitch of the wound spiral becomes relatively small, which has as a consequence that the one component of the grinding force that acts perpendicularly to the abrasive web joint is correspondingly small and the danger of the abrasive web tearing loose from the edge on is absent.

Through experiments it was determined that with hole-like damages of the adhesively bonded abrasive web, the rim of the hole does not change, that the entire abrasive layer is thus not destroyed through local damages.

In order to prevent the pointed ends of the abrasive web and/or adhesive synthetic material foil web from unintentionally coming loose at the ends of the roll 1, at each of the two ends of the grinding cylinder a thin steel tightening strap 10 is usefully pulled over the abrasive web.

To exchange the abrasive web, the tightening straps 10 are removed, following which the abrasive web 6 together with the adhesive tape 2 is simply pulled off the roll 1. A cleaning of the surface of the roll 1 is not necessary because after pulling off the coating, no residues whatsoever remain on the surface of the roll 1. After the removal of the tapes 2 and 6 one may immediately mount onto the roll 1 a new adhesive synthetic material web 2 and following that a new abrasive web 6 in the previously indicated way. The time for exchanging the abrasive layer is considerably shorter than the time span needed for exchanging a conventional abrasive layer. Also unnecessary are the considerable time periods that must be spent if the felt of a conventional grinding cylinder covering must be replaced because of damaging or hardening.

The time needed with a grinding cylinder according to the invention for exchanging the abrasive layer can further be reduced considerably if instead of the double-sided adhesive synthetic material web and the abrasive web one uses an abrasive web which was laminated beforehand with an adhesive foil or was coated itself directly with a self-adhesive adhesive material.

In order to design the grinding effect of the grinding cylinder such that it is similar to that of a broad belt contact grinding machines with contact rolls, a sleeve 11 of rubber or a similar material may be provided between the roll 1 and the layer 2, 6 (Fig. 3). Such a sleeve 11 is first and foremost vulcanized onto the roll 1. Its thickness can vary within relatively broad limits, it may lie, for example, between 3 and 25 mm. The thickness and the Shore hardness of the sleeve 11 are suited to the intended use. Through the rubber coating, the cylinder surface becomes somewhat flattened, such that the abrasive remains in contact over a longer distance, through which the quality of the abraded surface is improved. Should the surface of the rubber sleeve be damaged due to whatever circumstance, then it is possible without difficulty to grind or pull off the sleeve so far that the damage is removed.

Claims

1. Grinding cylinder for grinding plate-shaped parts of wood or similar materials, with cylindrical roll and abrasive web applied onto it, characterized in that the abrasive web (6) is dimensioned relatively narrow, for example, has a width of 100 to 150 mm, and is spirally wound onto the roll (1), with the edges abutting against one another practically gap-freely, and connected to [the roll] through an adhesive bond.

2. Grinding cylinder according to claim 1, characterized in that a sleeve (11) of rubber or similar material is vulcanized onto the roll (1) and that the abrasive web (6) is fastened to this sleeve via an adhesive bond.

3. Grinding cylinder according to claim 1 or 2, characterized in that the adhesive bond is formed by an adhesive directly between the roll (1) or sleeve (11) and the abrasive web (6).

4. Grinding cylinder according to claim 1 or 2, characterized in that the adhesive bond is formed by a double-sided adhesive synthetic material web (2), where this is dimensioned relatively narrow, for example, having a width of 100 to 150 mm, and is wound spirally onto the roll (1), with the edges (3, 4) abutting largely free of gaps.

5. Grinding cylinder according to claim 4, characterized in that for the width of the double-sided adhesive synthetic material web (2) and of the abrasive web (6) being equal, the abutting locations are provided to have the joints shifted with respect to one another.

6. Grinding cylinder according to claim 1 or 2, characterized in that on its back side, the abrasive web (6) is laminated with a self-adhesive foil and is adhesively bonded by means of it to the roll (1) or the sleeve (11).

7. Grinding cylinder according to claim 1 or 2, characterized in that on its back side, the abrasive web (6) is directly coated with a self-adhesive adhesive material.